lecting event to avoid contamination by the cleaning liquid.

DISCLOSURE OF THE INVENTION

In order to accomplish these results the invention provides an automated water sampling system for collecting multiple samples of sample water at a remote site. A multiport valve provides a plurality of ports and respective port inlets. A sample water intake line is coupled to the respective port inlets. The multiport valve is constructed for individually opening and closing the port inlets. A plurality of sample receivers or sample containers are coupled to respective ports of the multiport valve. At least one container of cleaning liquid is also coupled to a port of the multiport valve.

According to the invention an output manifold provides a plurality of manifold outlets coupled to the respective sample receivers and to said at least one container of cleaning liquid. A pumping water output line is coupled to the plurality of manifold outlets. A reversible pump is coupled in the water output line for pumping and drawing sample water through the intake line into selected sample receivers and for pumping and pushing cleaning liquid from said at least one cleaning liquid container out the sample water intake line.

A programmable controller is coupled to the multiport valve and pump for fully automated operation. The controller is programmable to cause pumping and drawing of sample water into the intake line and into respective sample receivers in series in a timed sequence of sample collecting events. The controller is also programmable for reversing the pump and pumping and pushing cleaning liquid from at least one cleaning liquid container out the intake line to wash away biofouling material between the sample collecting events.

In the preferred example embodiments the water sample receivers are each constructed as an elongate container having a sample water opening at one end, a pumping water opening at the other end, and a slidable sealing piston contained within and slidable between the ends of the elongate container in response to differential pressure across the piston. Each elongate container is coupled to a respective port of the multiport valve at the sample water opening end and to a respective manifold outlet of the output manifold at the pumping water opening end.

At least one cleaning liquid container is also constructed as an elongate container having a cleaning liquid opening at one end and a pumping water opening at the other end. A slidable sealing piston is contained within and is slidable between the ends of the elongate container in response to differential pressure across the piston. The elongate container of cleaning liquid is coupled to a respective port of the multiport valve at the cleaning liquid opening end and to a respective manifold outlet of the output manifold at the pumping water opening end.

The initial position of the piston in respective sample receivers before a respective sample collecting event is adjacent to the sample water opening end of the elongate container. The elongate container is back filled with pumping water from the pumping water opening end. The starting position of the piston in the cleaning fluid container is adjacent to the pumping water opening end with the elongate container filled with cleaning liquid.

The invention contemplates a variety of embodiments in which the sample receivers can be syringes, elongate cylindrical sample collecting tubes, and flexible bags. In the flexible bag embodiment, each flexible bag is enclosed within the elongate container with an opening coupled to the respective port through the sample water opening end of the elongate container.

The multiport valve is generally constructed with a valve head having multiple ports and port inlets arranged in substantially circular configuration. A distributor rotor bears against the valve head for rotation to different rotational positions. The rotor forms a seal between the rotor and valve head. The distributor rotor is formed with a coupling channel for coupling the sample water intake line to different port inlets and respective ports according to the rotational position of the rotor.

In the preferred example the valve head and distributor rotor are formed with flat bearing faces for sealing and closing all port inlets and ports when the rotor is in rotational positions with the coupling channel between ports. The bearing face of the valve head is formed with a circular channel having a first diameter coupled to the water sample intake line. The bearing face of the valve head is also formed with a circle of holes providing the port inlets. The port inlet holes are arranged in a circular ring having a second diameter different from the first diameter of the circular channel but concentric with the circular channel. The circular ring of port inlet holes may actually be arranged in a double ring to accommodate larger numbers of port inlet holes for multiport valves with many ports. The bearing face of the rotor is formed with a radial coupling channel extending in a radial direction between the circular channel and circular ring of port inlet holes of the valve head.

A cleaning liquid container of cleaning liquid is also coupled to a cleaning port of the multiport valve for washing away biofouling material from the sample water intake line. Another elongate container of flushing liquid is coupled to a flushing port of the multiport valve for flushing away cleaning liquid. The controller is programmable for operating the pump in reverse for first pumping and pushing cleaning liquid out the sample water intake line and then pumping and pushing flushing liquid out the sample intake line for flushing away the cleaning liquid.

The invention also provides a new method for automatically sampling water at a remote site using a multiport valve having a plurality of ports and respective port inlets. The method is composed of steps for alternately collecting water samples and cleaning and flushing the sample water intake line between the sampling events. Other objects, features and advantages of the invention are apparent in the following specification and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a Simplified diagrammatic view of the water sample collecting system according to the invention.

FIGS. **2**,**3**, & **4** are detailed side diagrammatic views of a water sample collecting tube with sliding piston according to the invention showing in sequence three stages namely before, during and after a water sample collecting event. In opposite sequence, FIGS. **4**, **3**, & **2** show operation of the cleaning liquid container and flushing liquid container during an entire cycle of a plurality of water sampling events.

FIG. **5** is a detailed side cross section view of a single head multiport valve for controlling flow of sample